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Precordial Impulses

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Definition

Precordial impulses are pulsations originating from the heart or great vessels that are visible or palpable on the anterior chest wall.

Technique

Initially have the patient lie in a comfortable supine position with the trunk elevated 30 to 45 degrees. If the left breast obscures an impulse, it should be lifted out of the way. The patient should exhale slowly and hold at end expiration during observation and palpation. Adequate overhead lighting is essential for observation, which can be enhanced by a penlight aimed tangentially.

Stand at the patient's right side and gaze tangentially at each precordial area of importance (Figure 21.1A), imagining the cardiovascular anatomy underneath (Figure 21.1B). The apex impulse is sought, followed by a search for additional pulsations. Each impulse should be characterized by location, size, contour, and timing.

Carefully palpate pulsatile areas with the fingertips and the palm of the right hand. Determine the location, size, force, and duration of impulses. The examination should be repeated with the patient in the left lateral decubitus position.

Tips to Improve Technique

1. Experience is indispensable, so be patient. Hundreds of examinations are necessary with clinical and laboratory correlation in order to hone this skill.
2. Anticipate a "warm-up" phenomenon. Visual and tactile perception will improve after concentration for a few moments.
3. Apical *location* often can be best estimated by observation or palpation of the apex with the patient sitting up, leaning forward, and exhaling.
4. Turning the patient into the left lateral decubitus position improves appreciation of the *contour* of the apical pulsation, but prolongs the thrust and displaces it laterally.
5. To best appreciate *timing* of impulses, it is essential to auscultate heart sounds simultaneous with observation and palpation. Palpation of the carotid artery is also helpful for timing but the 40 msec delay before the carotid upstroke can be a source of confusion, especially in the setting of tachycardia.

Basic Science

The apex impulse generally results from precordial displacement by the interventricular septum as it thrusts forward during isovolumic contraction of the ventricles. Maximal precordial motion occurs with, or just subsequent to, aortic valve opening. The impulse falls away with ejection of blood.

Ventricular enlargement and hypertrophy often alter the area of the myocardium that abuts the chest wall to cause the impulse. With left ventricular enlargement, the septum rotates medially and the anterolateral wall of the ventricle constitutes the apex. As the right ventricle enlarges, it may cause the apical impulse. Ventricular contraction causes the left ventricle to move both downward and laterally (counterclockwise), while right ventricular motion is anterior and medial (clockwise). This motion can be detected by the examiner to differentiate between a right and a left ventricular impulse.

The finger is sensitive to both amplitude of motion and frequency of vibration. In general, outward pulsations are better palpated than observed, whereas the reverse is true with inward motion. The low-frequency vibrations associated with diastolic filling abnormalities, which are auscultated as third or fourth heart sounds, can often be observed but not palpated or auscultated.

Clinical Significance

All precordial impulses are observed and palpated with consideration of location, size, and character, which includes duration, force, and contour.

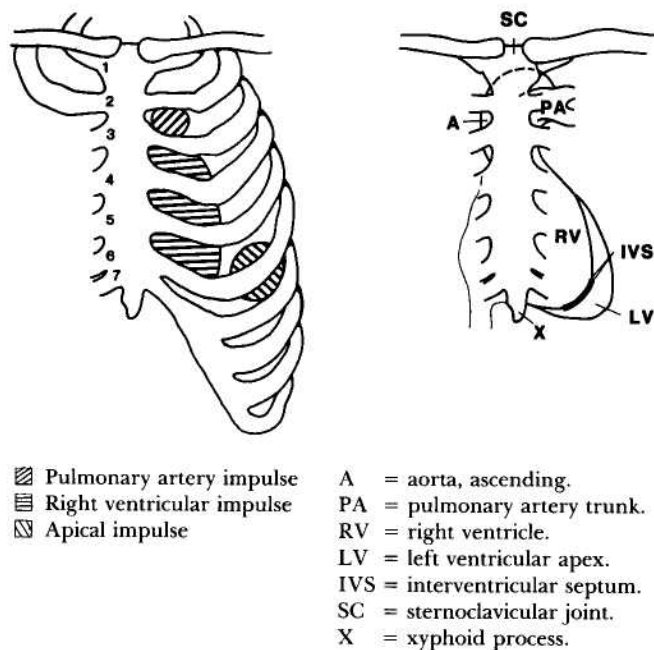


Figure 21.1
Cardiac anatomy and precordial pulsations.

Apex Impulse

The normal apex impulse is less than 3 cm in diameter, localized within the midclavicular line, and brief in duration, that is, lasts less than two-thirds of systole and is palpated as a tap upon the fingertip.

Location is the least reliable characteristic to measure, as many patients with normal hearts have impulses lateral to the midclavicular line. Furthermore, the left lateral decubitus position is essential for examination, and it almost invariably rotates the apex laterally.

Diameter of the palpated impulse should be less than 3 cm in both supine and left lateral positions. Size greater than 3 cm is indicative of left ventricular hypertrophy or enlargement. (For reference, the diameter of a quarter is 2.4 cm.)

The apex impulse generally peaks within the first third of systole and has returned to baseline by the time systole is two-thirds complete; this is sensed as a tap by the palpator. A sustained thrust timed to last throughout systole suggests an enlarged or hypertrophied ventricle.

Degree of thrust is subjective, and accuracy of an examination is proportional to the examiner's experience and interest. Increased amplitude is seen in "excitable" states, as caused by fever, anxiety, anemia, or hyperthyroidism. Increased amplitude is also found in enlarged or hypertrophied ventricles capable of vigorous contraction.

Contour is also important (Figure 21.2). The apex is generally observed or palpated as a single systolic outward motion. Double systolic impulses are often present in hypertrophic cardiomyopathy or left bundle branch block. An early diastolic impulse can correspond to the auscultated third heart sound and is found in normal hearts in young

or thin patients or in dilated ventricles in chronic heart failure or volume overload states. An extra impulse in late diastole occurs after atrial contraction; it corresponds to auscultation of the fourth heart sound and is observed in hypertrophied or noncompliant ventricles (for example, patients with systemic hypertension, aortic hypertension, aortic stenosis, hypertrophic cardiomyopathy, or angina pectoris).

Patients with hypertrophic cardiomyopathy often have a triple apical impulse, with a pulsation in late diastole and two in systole. Rarely, a quadruple impulse is present when rapid ventricular filling in early diastole is also appreciated. Systolic retraction of the apex followed by diastolic expansion is described in constrictive pericarditis. Unless the timing of systole and diastole is corroborated, this finding will be mistaken for normal. Systolic retraction may also occur in the apical area when there is a prominent parasternal lift from right ventricular hypertrophy.

The apical impulse must be interpreted in the proper context for each patient. For example, a tapping, 2-cm, midclavicular impulse in an obese patient with obstructive pulmonary disease may represent severe left ventricular hypertrophy or enlargement, as the apex is rarely discernible in these patients. Alternatively, a thin person with a straight back and pectus excavatum may have a lateral, forceful impulse with an entirely normal heart.

Parasternal Impulse

A slight outward pulsation occasionally is present in children or thin adults with normal hearts. Generally, however, a left parasternal impulse is caused by a dilated or hyper-

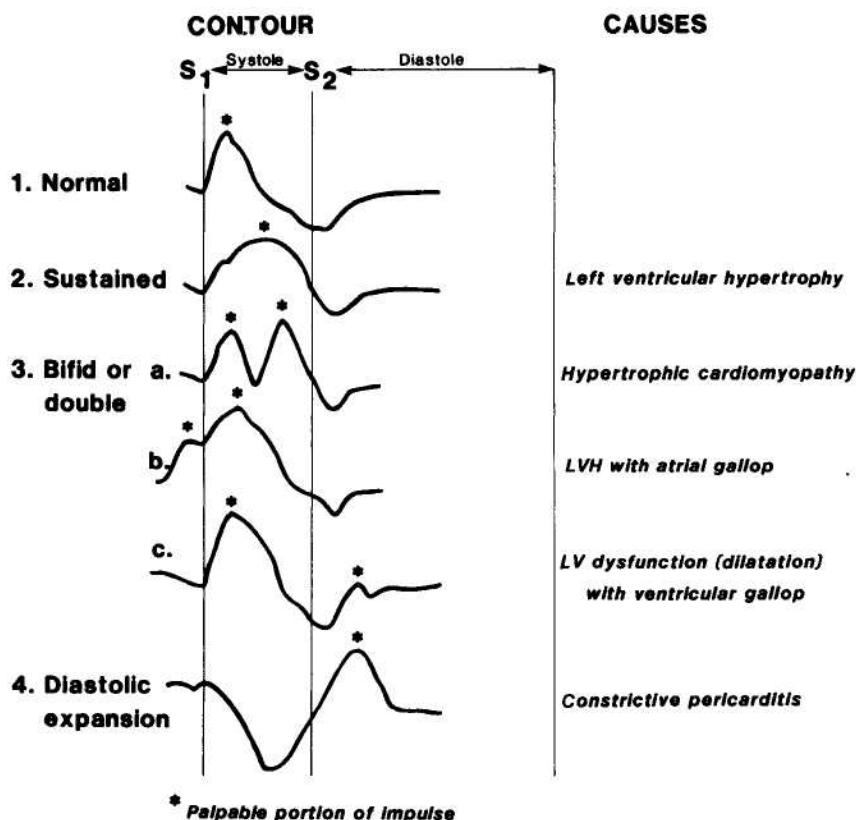


Figure 21.2
Apical impulse: its timing and contour.

trophied right ventricle. A dilated right ventricle is often associated with excess volume, and the impulse may be vigorous and brief, whereas the impulse of an hypertrophied right ventricle is sustained.

The most common condition associated with right ventricular dilatation is functional tricuspid regurgitation; less frequent causes include right ventricular infarction, atrial septal defect, pulmonic insufficiency, and ventricular septal defect. A systolic thrill at the left lower sternal border is characteristic of the latter condition.

Right ventricular hypertrophy is generally secondary to pulmonary disease or severe chronic left ventricular failure. Less common causes include mitral stenosis, pulmonary stenosis, or primary hypertension of the pulmonary artery or veins.

Severe mitral regurgitation may cause a precordial pulsation in the absence of pulmonary hypertension. This impulse tends to peak late in systole and is caused by regurgitant flow into the left atrium, expanding it and lifting the anterior right ventricle against the chest wall.

Pulmonary Artery Pulsation

A pulsation in the second left intercostal space is normal only when found in children or young, thin adults. It should be distinguished from the discrete tap often felt with closure of the pulmonic valve.

A sustained impulse is found in the numerous causes of pulmonary hypertension. A briefer, more forceful impulse is found in high-volume states with pulmonary artery dilatation.

Other Precordial Impulses

Pulsation of the sternoclavicular joint can be an important subtle finding of dissecting aneurysm. All types of aortic disease with proximal dilatation rarely can cause this pulsation.

Ectopic systolic pulsations are most frequently found medial and superior to the apex. They can be dyskinetic (e.g., bulge outward in systole) when caused by a left ventricular aneurysm. Transient dyskinesis can occur with myocardial ischemia. Patients with severely dilated left ventricles often have a diffuse, rocking apex impulse that feels dyskinetic, although a true aneurysm is absent.

Ancient scripts in Chinese, Egyptian, and Hebrew describe the fascination of viewers with chest impulses caused by the beating heart. Our current understanding of precordial observation and palpation has developed from observations carefully recorded over many centuries. Perloff has written an excellent brief summary of the evolution of this knowledge.

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